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REVISION SERIES

EXERCISE THERAPY

By NANCY SALTER, B.Sc.
From the Medical Rehabilitation Unit, R.A.F., Chessington

THAT the power of normal muscle groups can be improved by constantly practising tasks involving strength has been known for centuries. One may recall the legend of Milo of Crotona, who is reputed to have lifted a calf every day until it had grown into a bull. Similarly it has long been held that practice of a particular skill involving endurance or co-ordination improves that skill and, to a lesser extent, increases endurance and co-ordination in other tasks.

Gardiner (1930) traced the development of athletic exercises in ancient Greece, beginning with the sixth century B.C. At this time exercises were connected with military training and the maintenance of physical health and vigour, and weight-lifting is known to have been popular for developing strength and physique. Diet and healthy living were considered an important part of training, but specific exercises were not carried out till the rise of professionalism several centuries later. The practice of skills, such as throwing the javelin, was carried out both as military training and in preparation for athletic festivals. Gardiner mentions that by the second century A.D. a regular system of dumb-bell exercises was in existence for strengthening various parts of the body.

The earliest work in English on the value of physical exercise is Sir Thomas Elyot's *The Governour* (Armytage, 1952). Elyot was influenced by the new knowledge and appreciation of human anatomy in the early sixteenth century, and was well aware of the value of exercise in developing "hardness, strength and agilitie". Ling, the creator of Swedish gymnastics who lived at the end of the last century, successfully reintroduced medical and remedial gymnastics, realizing

the value of exercise in abnormal as well as normal conditions. According to Plato, the science of medical gymnastics was invented in the fifth century B.C. by Herodicus of Selymbria!

During the last fifty years physical education has become increasingly important both in schools and in the field of competitive sport, and the knowledge gained in these spheres has been of considerable value to those concerned with prescribing exercises for both normal and diseased muscles. The use of therapeutic exercise in rehabilitation has increased progressively over the last forty years. This is due to the problems produced by the large number of war injuries, the increasing incidence of road accidents, and the prevalence of poliomyelitis and degenerative joint disease. Some research has been carried out on the problems of exercise therapy in rehabilitation, but the basis of most of the techniques in common use is largely empirical. Further work is in progress to determine optimum methods.

AIMS OF EXERCISE THERAPY

The aim of therapeutic exercises is to improve the functional capacity or general "usefulness" of muscles or muscle groups. The importance of the psychological effect of therapeutic exercises is not discussed in detail. Assuming the range of movement to be within normal limits, the usefulness of a muscle group depends on three factors: strength, endurance, and co-ordination. Strength is measured as the absolute force the muscles can exert in single contractions. This is perhaps usually the main function of these exercises, but strength is of limited value if the muscle has no endurance. Endurance is the ability of a muscle to maintain a contraction over a period of time or to make repeated exertions through a given range at a given rate over a period of time. Co-ordination is defined as the ease with which contractions can be made speedily and accurately. This paper is not concerned with conditions in which lack of co-ordination is the major factor—e.g. disseminated sclerosis. Co-ordination is considered only in so far as it is associated with muscle weakness.

Until recently scant attention has been paid to these three factors. The optimum exercises for developing each property of the muscle are still far from being clearly defined.

Exercises for weakened muscles here considered fall into two groups: (1) muscles which are weak from disuse—e.g. following immobilization or trauma; and (2) those which are partly paralysed or in which reinnervation is progressing—e.g. after suture of a nerve lesion or following acute poliomyelitis. Therapeutic exercises normally form only part of the total treatment. In many

rehabilitation centres a policy of full-time intensive treatment with varied routines of specific remedial exercises, remedial games, physiotherapy, and occupational therapy is now followed.

TECHNIQUES OF THERAPEUTIC EXERCISE

Certain features of therapeutic muscular exercise are agreed upon. It is generally accepted that exercises for building up strength, endurance, and co-ordination should consist of active voluntary movements so that the neuromuscular system acts in the normal physiological way (Elsom, 1935; Gaenslen, 1935; Northway, 1942; Kraus, 1943; Tegner, 1951). It must be remembered, however, that there is no experimental proof that in man electrically induced contractions are not as effective as voluntary exercise. Work in progress at this centre suggests that electricity can provoke a contraction equal in strength to a maximal voluntary contraction. The obvious criticism of electrotherapy is the lack of patient participation, which may well be of importance in laying down central movement patterns.

Most workers agree that active exercise should be progressive (Nicoll, 1943; Snow and Gurewitsch, 1942; DeLorme, 1945)—i.e. that more effort should be required of the muscle as it improves.

The amount of resistance recommended by different authors varies widely, and there is also disagreement concerning the range of movement through which the muscle should be exercised and the number and spacing of both individual muscle contractions and exercise sessions. The last two factors, together with the resistance applied, determine the degree of fatigue (decrement in applied muscle strength) which will result from an exercise session. The question of the amount of fatigue which is necessary or desirable has yet to be resolved.

Very few exercise routines are described in detail in the literature; it is more usual to find broad principles which may be followed with variations to suit individual requirements. The simplest exercise consists of repeated static contractions—e.g. quadriceps setting. This is useful when no joint movement is possible. The simplest form of progressive isotonic exercise is that in which gravity provides the required assistance or resistance to muscular contraction. Very weak muscles may initially be assisted to complete the range of movement merely by the elimination of gravity. From assisted movements the patient progresses to free movements, and from there to movements against gravity and gradually increasing resistance. Delicate grading of gravity resistance can be achieved by the patient moving the limb over a powdered board, the angle of which can be altered to provide the required degree of assistance or resistance (Mackenzie, 1941).

DeLorme's Routine

A number of exercise programmes are concerned with weight-lifting, the routine being derived in some measure from training programmes used by professional weight-lifters. The most carefully described exercise routine of this type is one recommended by DeLorme (1945). He emphasized that therapeutic exercise should be classified according to the quality developed in the muscle, and that his "high resistance–low repetition" exercise developed power (strength) while "low resistance–high repetition" exercise developed endurance. DeLorme's routine was devised originally for the quadriceps, but the principle is applicable to almost any muscle group. The exercises are based on a load called the "10 repetition maximum" (10 R.M.), which is the greatest load that can be lifted ten times through the full range of movement. This is determined by carrying out a number of "sets", a set consisting of ten consecutive lifts through the complete range. The subject starts with a set using a relatively light fixed load, and after a one-minute rest the set is repeated with a slightly heavier load. This routine is repeated with a fixed increment in load until ten contractions through the whole range cannot be made. In this way the 10 R.M. is always determined under comparable conditions of warming up and fatigue.

DeLorme's exercise originally consisted of seven to ten sets, starting with a proportion of the 10 R.M. and gradually increasing the load so that the final set was done with the 10 R.M. Later this routine was modified to three sets, using $\frac{1}{2}$, $\frac{3}{4}$, and 1×10 R.M. (DeLorme and Watkins, 1948). The patient is instructed that the load should be lifted smoothly and rhythmically through the full range, a short pause being allowed between lifts and a one-minute pause between sets. The exercise session, consisting of three sets, is repeated on four days a week, a new 10 R.M. being assessed on the fifth day. The 1 R.M. (maximum load that can be carried once through the whole range) is also measured weekly.

The schedule was originally given the name "heavy resistance exercise", but this was later changed to "progressive resistance exercise" (P.R.E.) because the term "heavy" was misleading, the load not necessarily being heavy in an absolute sense but only in relation to the work of which the muscle was capable. For very weak muscles load-assisted exercises were recommended, using the 10 repetition minimum—i.e. the minimum load required to assist the muscle to complete the range of movement ten times.

The drawback of DeLorme's technique is that it is time-consuming, and therefore not suitable for use with large numbers in busy departments.

Zinovieff (1951) recommended a modified DeLorme technique. He found that his patients fatigued by lifting half and three-quarters of the 10 R.M. were unable to make ten repetitions with the 10 R.M. He therefore suggested that the sequence be reversed and the load gradually decreased—i.e. the first set with the

10 R.M. followed by the second set with $\frac{3}{4} \times 10$ R.M. and the third with $\frac{1}{2} \times 10$ R.M. In this way the effort required parallels the capabilities of the muscles, and the same total amount of work as in DeLorme's routine is carried out.

In both DeLorme's and Zinovieff's techniques the muscles are required to do heavy work but are not exercised to complete exhaustion. Similarly, Hellebrandt and her colleagues (1948) recommend short bouts of intensive exercise, which produce only incomplete fatigue, for the development of muscle strength. They suggest 10 to 20 sets, each consisting of 25 to 40 contractions, with one-minute rest pauses between sets. Each set is carried out with the same load, the load being chosen to produce an arbitrarily selected degree of fatigue (fatigue being measured by the decrease in work done). The load is increased as soon as it produces less than the selected degree of fatigue. These workers state that speed, rhythm, and load may be varied to elicit the desired physiological effect; for example, exercise with a light load is useful for mobilizing joints, stimulating the circulation, and augmenting work tolerance (i.e. endurance).

Russell (1956) supports the idea that intensive exercise is not harmful. With poliomyelitis patients he introduced such exercise for five minutes once an hour for ten hours a day. Resistance was provided with either weights or springs, repeated contractions being carried out. The timing of this exercise schedule differs from the others mentioned. Kraus (1943) states that timing is important, and that the result of exercising for one hour once daily differs from that obtained by five minutes' exercise twelve times a day. However, he gives no further details.

MacQueen's Method

MacQueen (1954) considers that a much more strenuous weight-lifting routine than that suggested by DeLorme can be used with advantage on weakened muscles. His recommendations are based on the training programmes used by professional weight-lifters and involve working the muscle to exhaustion. A suggested regimen is as follows: One set of ten lifts with the 10 R.M. followed by sets of the maximum possible number of lifts with gradually increasing loads, until the 1 R.M. is reached. This is followed by several attempts to lift a weight greater than the 1 R.M., and when this is eventually achieved a new 1 R.M. is established. MacQueen states that "the key to the development of power (strength) is decreasing the number of repetitions with increasing poundages, together with frequent attempts to increase the weights used".

MacQueen also describes a slightly less vigorous routine for developing muscle size rather than strength (though an increase in strength does result). An average routine followed by "body-builders" comprises four sets of lifts with

the 10 R.M. on three days a week only. He emphasizes the importance of concentration of the will on producing extreme contraction of a muscle while it is working against a great and increasing resistance.

Contrary to the other workers mentioned, MacQueen advocates "cheating" when lifting heavy weights. He states that the cheating method, which enables a greater weight to be handled, although recruiting the contraction of neighbouring muscles, may make a greater demand on the particular muscle being developed than the normal method. This is reminiscent of the "mass movement" facilitation principle of Kabat.

KABAT'S METHOD

Kabat (1952) made a number of studies on neuromuscular dysfunction, and his papers stress the theoretical approach to the problem of the restoration of motor function. The rationale for the exercise regimen he recommends is as follows: When a motor unit responds to a stimulus the response is maximal (all-or-none law), and a low-resistance exercise produces a maximal response in some motor units (and always the same "low threshold" units) and none in others. Since he considered that it is motor-unit activity which results in therapeutic benefit, the aim should be to excite all available motor units in voluntary effort. This is done by means of central facilitation—i.e. increasing the level of central excitation so that more anterior horn cells fire off. Kabat suggested that central facilitation could be brought about in several ways, which could be used separately or together. The first mechanism is the use of maximal resistance. A large proportion of available motor units are brought in to contract against this, the level of excitation being raised by proprioceptive facilitation (see later). This factor is also concerned in the second mechanism, which is that of muscle stretch. A combination of stretch and maximal resistance produces greater facilitation than either alone.

The third suggestion is that exercise should be by "mass movement" patterns, and not by the activity of isolated muscles. In this way Kabat claims that normal activity is stimulated and facilitation is by the overflow of excitation from active areas. Using this technique, muscular contraction has been demonstrated in apparently paralysed muscles, contraction which could not be elicited in any other way. The "overflow" facilitation mechanism also operates if a reflex response is used to reinforce a voluntary one. The final facilitation mechanism Kabat calls "reversal of antagonists". If a muscle contraction is immediately preceded by a contraction of the antagonists the resulting contraction is greater than it would otherwise have been. This employs the movement which is used subconsciously in kicking, for example, or chopping wood. Kabat claims

good results from the practice of these principles of exercise, but gives no quantitative details in support of his claim.

Guthrie Smith's Exercises

The exercise techniques so far described seem to be more suitable in cases where relatively few movements are affected and where the weakness is not very severe.

Active voluntary exercises suitable for very weak muscles following recent injuries and paralysis have been devised by Guthrie Smith (1949). Like other workers, she emphasized the importance of natural voluntary movements and recommended gradual progression from assisted to free to resisted movements. With the use of slings and springs a system was devised whereby the body, or any part of it, can be suspended so that it is completely relaxed. In this way all the effort can be directed towards the muscle in question, and, since the movements are made under the patient's control, the maximum amount of movement without pain can be achieved. Using suitably arranged springs and pulleys, single muscles or muscle groups can be isolated, the balance between prime movers and antagonists maintained, and bilateral exercises for unequally affected muscles given. Graded springs and weight-and-pulley systems provide the necessary assistance or resistance to movement. Kraus (1943) pointed out a disadvantage of using springs for resistance—that there is an increase in resistance at the stage where the muscle is least able to overcome it. He also stated that in using pulleys the alternation of movements between the healthy and injured extremities is helpful, for the injured side can learn from the uninjured. Guthrie Smith also stressed the importance of making rhythmic contractions--i.e. alternating work and rest—and of avoiding fatigue. More recent work, already described, indicates that a certain amount of fatigue is not harmful to weak muscles, and Guthrie Smith's system can be, and often is, modified for heavy work.

The Problem of Fatigue

The whole problem of fatigue in therapeutic exercise requires investigation. Before the introduction of progressive resistance exercise (DeLorme, 1945) many workers stressed the importance of avoiding fatigue (Elsom, 1935; Gaenslen, 1935; Mennell, 1942; Snow and Gurewitsch, 1942). The general trend to-day seems to be to use heavier and more fatiguing exercises, but the optimum level of fatigue has not been calculated. There is still a difference of opinion concerning the use of fatiguing exercises in the early stages following acute poliomyelitis, some workers having found deterioration in muscle strength after over-strenuous exercise.

EXPERIMENTAL INVESTIGATIONS

Apart from the knowledge derived from the clinical use of various exercise routines, several experimental investigations have recently been carried out specifically to study the problems of muscle training. This was made possible by the development of reliable tests of measurement of muscle strength and endurance. Using normal subjects, Baer *et al.* (1955) studied the effect of various exercise programmes on isometric tension, work capacity, and reaction time. Darcus and Salter (1955) and Salter (1955) carried out similar investigations, measuring only changes in muscle strength. In all cases the exercise session was carried out once a day for four or five days a week for four to six weeks. Baer *et al.* compared isotonic contractions with two different weights, isometric contractions, and a complex movement, his subjects making ten contractions only, at a rate of either 10 or 30 per minute. They found the greatest improvement in subjects exercising with a high resistance (either isometric or isotonic) at ten contractions a minute. The other workers compared 30 isometric with 30 isotonic contractions, made at a rate of one, two, or fifteen per minute. No significant difference was demonstrated between these six routines. Further work is in progress in an attempt to determine the optimum values for the different variables.

It is of considerable clinical importance to know if exercise in one position of the joint only is as efficient as in any other, or as isotonic contractions, and if fatigue is an important factor. The restoration of function of the quadriceps in a flexion contracture of the knee due to rheumatoid arthritis is an obvious example.

Several investigators in recent years have demonstrated the phenomenon of cross-education in experimental subjects (Hellebrandt *et al.*, 1947; Darcus and Salter, 1955). They have shown that exercise of one side of the body results in an increase in strength of the corresponding muscle group on the other side. Hellebrandt and Houtz (1950) have also shown that simultaneous exercise of both sides increases the work capacity of the weaker side. It is possible that these findings might be of value in therapeutic exercise.

Care must be taken in applying the results of experiments on normal muscles to remedial exercises for diseased muscle. Furthermore, there is evidence to suggest that the problem of wasted muscles in diseases mainly affecting joints —e.g. rheumatoid arthritis—is different from that of weak muscles round normal joints. Electrodiagnostic investigations in rheumatoid arthritis have shown that there are disorders of neuromuscular function in the affected muscles, and it may well be that the correct exercises to restore function in these muscles differ from those prescribed for weak muscles following fractures, etc. Clearly it is not wise to assume that the techniques will necessarily be the same.

As well as providing the basis for the exercise programmes of DeLorme and MacQueen, the principles of the intensive and progressive exercise used by weight-lifters have been tried out in the field of physical education. Adamson (1953) compared this type of exercise with the normal school physical education programme, and demonstrated its superiority in augmenting muscular strength, power, and endurance and circulo-respiratory endurance. The "circuit" training he used (Adamson and Morgan, 1954) involved one 30-minute period per week, using some gymnastic apparatus. The subject performed a series of prearranged exercises at one-third of his maximum ability (e.g. one-third the maximum number of press-ups), the dosage being increased when he could lap the circuit three times in half an hour.

PHYSIOLOGICAL BASIS OF EXERCISE THERAPY

Most workers agree that systematic active exercise is essential for functional recovery following injuries or diseases of the neuromuscular system. Irrespective of the type of exercise carried out, repeated activity of muscles results in the acquisition of skill and ease of muscle action and the development of precision and co-ordination. Watkins (1948) has stated that the greatest single factor in improvement in muscle performance is learning; the patient's concept of effort changes, as does his willingness to exert himself despite discomfort. Improvements occurring should be interpreted with care for this reason. Two factors which are important in this connexion for anyone prescribing or supervising exercise are: (1) it is essential to retain the active and intelligent co-operation of the patient during the exercise period; and (2) the exercise routine should be as variable as possible in order to prevent boredom.

Muscle action results in a temporary improvement in muscle blood supply. Repeated activity may result in the opening up of new capillary channels. Heavy exercise results in the co-ordinated development of the circulatory, respiratory, and nervous systems. Apart from these general effects of exercise, it has been stated that systematic voluntary exercise facilitates the transmission of nerve impulses across the motor end-plates. It is claimed that this would lead to a more complete use of available muscle fibres (Elkins and Wakim, 1947). It is difficult to prove this.

It is known that weak muscles often respond to therapeutic exercise by hypertrophy. This increase in muscle bulk is not necessarily proportional to the increase in strength, for we have found that, following rehabilitation after meniscectomy, quadriceps function may be equivalent to that on the normal side although there is up to 1 inch of wasting. The actual site of the hypertrophy is uncertain. It has been shown in experimental animals that no new muscle fibres

are formed, but that an increase in size of existing fibres and an increase in the formation of new capillaries may occur (Petrén, Sjöstrand, and Sylvén, 1936).

It is generally agreed that movement through the maximum possible range without pain is most beneficial (Elsom, 1935; Northway, 1942; Molander and Weinmann, 1943; Ransohoff, 1944) partly because of the increase in blood and lymph flow which it produces. Isometric contractions—e.g. quadriceps setting—are valuable when joint movement is contraindicated, and experimental work has shown that, providing a high resistance to contraction is given, isometric exertions can be as beneficial as isotonic. Mennell (1942) advocated movement through only the inner range while a muscle is very weak.

Most present-day workers agree that, in order to develop muscle strength as rapidly as possible, muscles should be exercised in the "overload" zone—i.e. the amount of work performed should exceed that normally performed with ease (DeLorme and Watkins, 1948; Mead, 1950; Kabat, 1952; MacQueen, 1954). The mechanism by which resistance increases the power of muscular contraction and the proportion of active motor units is apparently related to the tension in the muscle. When the muscle contracts against a strong resistance the tension in the muscle is increased, and proprioceptive stimulation resulting from this facilitates the voluntary motor mechanism.

DeLorme's routine originally had a practical background rather than a theoretical basis. Introducing his technique for clinical purposes, DeLorme stated that the marked response in muscle hypertrophy and power with symptomatic relief seemed to contraindicate any possible violation of physiological principles. He also stated that competent physiologists who had seen the exercise being performed "felt fairly certain that the fatigue was at the neuromuscular junction and not of the muscle fibre". The degree to which muscles should be exercised in the overload zone has not yet been determined—i.e. whether or not it is necessary or desirable to exercise to exhaustion.

DeLorme has stated that in order to produce maximum hypertrophy and increase in muscle strength the heaviest load should be imposed on the muscle as it approached complete contraction. MacQueen confirms this and states that the principle has long been known by weight-lifters to produce rapid gains in size and strength. This is presumably because more muscle fibres are required to deal with a given load when the fibres are short (and the contractile force therefore low) than at the beginning of the contraction.

Kabat demonstrated a high degree of facilitation when a muscle was stretched prior to contraction. This may be explained by the servo-mechanism which controls muscular movement. The sensory receptors in the muscle, the muscle spindles, are in parallel with the muscle fibres and signal information to the spinal cord concerning differences in length between the main and the intra-

fusal fibres. In the maintenance of normal posture, a lengthening of the muscle increases this difference and excites the stretch reflex, through which the muscle returns to its normal length. This self-regulatory mechanism is known as a servo loop.

Recent work on the muscle spindles has shown that the intrafusal fibres are innervated by small motor nerve fibres. During postural contraction, tonic impulses passing down these nerve fibres maintain constant the length of the intrafusal fibres and thus the length of the whole muscle. Muscle shortening involves increased excitation and shortening of the intrafusal fibres, which increases the difference between the main and the intrafusal fibres and thus leads to muscle shortening by servo action. The effect of stretching the muscle prior to contraction is to increase still further the difference between the main and the intrafusal fibres, and thus produce a stronger contraction (Merton, 1953).

SUMMARY

It is difficult to assess critically the present position regarding exercise therapy, as few quantitative results are given in the literature, and where details are given, different criteria of improvement have been taken. Good results have been obtained in a variety of conditions when the DeLorme principle has been used, but it is impossible to compare these with any similar results from the use, for example, of MacQueen's technique.

During the last ten years the tendency seems to have been towards heavier exercise with less emphasis on avoiding fatigue, and it would appear that the most important factor to determine is the extent to which overload exercise is necessary and desirable in different conditions.

The following summary groups together those exercise programmes which are based on the same or similar principles.

I. Simple exercise without the use of apparatus

(*a*) Isometric contractions—e.g. quadriceps setting.

(*b*) Isotonic contractions with progression from gravity-assisted to free to gravity-resisted exertions.

(*c*) Kabat's technique, employing maximal resistance and facilitation principles to reinforce muscular contractions.

II. Exercises using springs, weights, and pulleys to provide resistance to muscle contraction

(*a*) Guthrie Smith technique, particularly suitable for very weak muscles.

(*b*) Russell's intensive exercise regimen for poliomyelitis cases.

(*c*) Exercises for building strength based on the progressive high resistance–low repetition principle.

i. DeLorme: This routine is carefully described, the patient using weights up to and including the 10 R.M. This schedule has been shown to be beneficial in a variety of abnormal conditions and is widely practised.
ii. Zinovieff: This is a modification of DeLorme's exercise programme, but there is no evidence to show that it is an improvement.
iii. Hellebrandt: This is also very similar to DeLorme's technique, but not as clearly defined. The routine allows for modification for building endurance—e.g. low resistance–high repetition exercise.
iv. MacQueen: This schedule is based on the type of weight training programme used for normal muscles, the patient using weights exceeding the 10 R.M. There is no evidence to show that this is necessarily suitable for weak muscles.

No work has been found recording any comparison between these different methods of exercise.

Improvements in exercise technique continue, with information gained from the practice of different routines in different spheres and from experimental work. The link between weight training methods, therapeutic exercise, and physical education has been demonstrated.

Much progress has indeed been made since 1581, when Richard Mulcaster wrote: "There be six circumstances, which leade and direct all exercises and are carefully to be considered of by the trayning maister: the nature of the exercise ye intend to use, the person and the body which is to be exercised, the place wherein, the time when, the quantitie how much and the maner how" (Armytage, 1953).

It seems possible that with opportunities for further experimental investigations and for the study of clinical routines in practice, the outstanding problems in exercise therapy may be answered.

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ORIGINAL PAPER

SELF-HELP AND THE ARTHRITIC PATIENT

By G. D. KERSLEY, EDITH C. BARKER,* AND CATHERINE COX†

From the Royal National Hospital for Rheumatic Diseases, Bath

THE rheumatic diseases constitute a national problem costing the country many millions of pounds. To the family in which one of these diseases strikes it is a menace which not only costs money, but brings in its wake problems of daily living affecting not merely the victim himself (or more often herself), but every member of the family, at its worst even threatening the maintenance of the family as a unit. During the last twenty years the application of our knowledge of the treatment of the rheumatic diseases has improved greatly. More should, however, be done to help patients by explanation and instruction, by home help and self-help, and, most important of all, by encouraging them to develop a better mental outlook.

GENERAL MANAGEMENT OF THE ARTHRITIC PATIENT

There are three main stages in the management of the arthritic patient: (1) the acute stage, where hospitalization is necessary; (2) the subacute stage, where the disease is still active but the patient is able to lead a fairly normal life; and (3) the stage where the disease may have burnt itself out but the patient is left with residual deformity of the joints and loss of muscle power. It is in the last two stages that the patient is so often left to stumble along as best he can with little or no help in readjustment and no guidance as to where help can be obtained. It must be remembered that the patient is not the only one needing help. The immediate members of the family have a great part to play in the rehabilitation of the patient. The fullest degree of independence must be the aim of all, and aids must be resorted to by the patient only when it has proved impossible or inadvisable for him to carry out a task without them.

Much can be done to avoid crippledom by means of medical treatment, but patients must have explained to them, truthfully and optimistically, the general pattern of the disease and what will help or hinder progress: the need to avoid strain both on joints and on general health, and how this can be achieved. Suitable exercises and a general way of life must be taught, and mental adjustment to the disease is essential to satisfactory progress.

To those who work outside the home, prolonged periods of enforced inactivity should be utilized to extend the range of interests without taxing

* Occupational therapist. † Hospital almoner.

physical strength. Libraries, evening classes, and club activities may bear little or no relation to the patient's previous occupation, but if he has to change his job they can act as a valuable pointer in other directions, and when physical strength returns the ability to do a day's work will follow more easily. Tricks must be learnt to circumnavigate disabilities, and in many cases simple gadgets may be obtained in order to allow the patient to care for himself or to carry out various tasks necessary for his livelihood. Assistance may be necessary from splints or special crutches; splints may be used not only to rest a joint but to improve function.

Ideally, an occupational therapist, an almoner, and if possible the physician himself, should visit the home and make suggestions aimed at uniting the family in the search for independence. Alternatively, the patient can attend hospital to be shown various ways of attaining independence. If both husband and wife can be interested, much may be achieved.

WELFARE

Help obtainable from the welfare services will vary according to the stage of the disease. The health visitor and local authority welfare officer will act as a useful liaison between the general practitioner and the medical officer of health and local authority, and will often assist by suggesting how the available resources can best be used in any particular home.

First, in the acute phase where hospital treatment is required, difficulties may arise over money or over the care of children or invalids. The National Assistance Board may make weekly allowances in cases of real need, and may give special grants for extra nourishment, fuel, laundry, etc., and, if necessary, pay fares to hospital. The local authority children's officer will take care of children if there are no available relatives, either boarding them out with foster-parents or placing them in a children's home. In order to free the arthritic housewife to obtain treatment, the local authority welfare department may be able to arrange for the temporary admission to a hospital or institution of the patient's aged or invalid dependants.

Secondly, in the subacute stage where the patient is able to lead a fairly normal life, the help required depends on his or her usual occupation, and whether it can be adapted to suit the patient's limitations or must be changed altogether.

Finally, where residual disabilities remain, although appropriate treatment from the start enables many to carry on their normal occupations, some of the less fortunate become too severely disabled to work and become quite helpless and a burden to themselves and their families. With skilled medical treatment and ingenuity in the use of gadgets and surgical appliances, many of these

patients can become fit to attend to their own needs, such as washing, dressing, and eating, and may be able to get about the house alone. They may need help from the various services mentioned above; they may also benefit from some of the following:

(*a*) *The District Nurse* may call to bath the patient regularly.

(*b*) *Home Nursing Equipment.* Medical loan depots are provided by the local health authority in every town, and branches are often run by the Red Cross. They can provide a bed cradle, air ring, back rest, etc., for use in the patient's home. Even a hoist to assist in transferring a cripple from bed to a chair or commode can be provided through the good offices of the medical officer of health (Sections 28 and 29 of the National Health Service Act).

(*c*) *Wheel Chairs* can be provided by the Ministry of Health on a consultant's recommendation.

(*d*) *Mobile Physiotherapy Service.* This operates in a few centres on a voluntary basis, patients paying what they can afford. Domiciliary physiotherapy can be ordered for short periods by a consultant, but much can be done by inexpensive home treatments with home-built apparatus if the patient and family are properly instructed in the principles required.

(*e*) *Handicraft Classes and Social Clubs* have now been organized in many places by the local authority welfare department, the British Red Cross Society, or the local voluntary organization for the care of the handicapped, independently or on behalf of the local authority. Transport is provided when necessary. These services are most valuable in that they give the patient outside interests and a chance to make friends.

(*f*) *Home Visiting and Handicrafts at Home.* In areas where there is a scheme for the welfare of the handicapped, home visiting is carried out either to deal with social problems or to maintain friendly contact, and in many areas there is also an occupational therapist or craft teacher available for the homebound.

(*g*) *Holidays* for the disabled at convalescent homes can be arranged, and there are now a few hotels and holiday camps where special facilities are provided. Local authorities or charitable bodies may be prepared to finance these holidays.

(*h*) *Residential Homes.* In the past the homeless disabled person usually had no alternative but to enter a long-stay hospital or institution in the company of the aged and dying. Special homes for younger disabled people (such as the Cheshire Homes) are now being set up by various voluntary bodies, and here the residents are encouraged to work, if they can, to help each other to occupy themselves to the fullest extent possible. Local authority welfare departments may pay for the keep of residents in such homes.

(*i*) "*Meals on Wheels*" is a service provided in many towns by the welfare authority through the W.V.S., the Salvation Army, or some other voluntary organization. For a very small charge cooked meals are delivered two or three times a week to elderly or home-bound people.

RESETTLEMENT

It is unfortunate that the present National Insurance Act does not recognize the intermediate and often lengthy period in an illness when a patient is able to do part-time work. Sickness benefit is forfeited if any paid work is done, and few people can support their families on part-time earnings alone. The housewife can extend her activities gradually, but for the man or woman who has to work outside the home it is a large step from semi-invalidism to full employment.

Help from the hospital almoner may be necessary with regard to change of occupation or help in the house. The advice and help of the Disablement Resettlement Officer (D.R.O.), industrial rehabilitation units, and the local welfare authority together with the British Red Cross Society are at the patient's disposal.

A "resettlement conference" between the patient, the physician, if possible the general practitioner, the almoner, the occupational therapist and physiotherapist, and the D.R.O. before the patient leaves hospital is often invaluable. But here again the attitude of the patient (which can be profoundly influenced for good or ill while in hospital) must not be forgotten. Richardson and Weir (*Rehabilitation*, 1956, **17**, 2) recently found that, for successful resettlement, age, skill, and particularly attitude to work were more important than disability.

WAGE-EARNERS

Many wage-earners with heavy or strenuous occupations find that they are unable to resume their normal jobs, or that, although they are still able to do the work, it aggravates their arthritis. Resettlement in more suitable work is not easy, particularly when the patient's hands are affected or if he is over 50, but with perseverance, adaptability, and an understanding employer, many arthritics do find satisfactory jobs and succeed in them.

(*a*) *Employers.*—Some of the bigger firms have facilities for providing alternative work for their arthritic employees and can be very helpful when the need is clearly understood.

(*b*) *The Ministry of Labour Disablement Resettlement Service.*—The D.R.O. at the local employment exchange will try to find suitable work for a disabled person and can, if necessary, arrange vocational training in a new trade. Where it is difficult to decide on the best job for a particular patient, or where

the patient has become low in health and spirits through illness and unemployment, a course at a Ministry of Labour industrial rehabilitation unit may fit him to make a new start.

(*c*) *Remploy Factories and Other Sheltered Workshops.*—The Government has established about fourteen Remploy factories (non-profit-making sheltered workshops) throughout the country, and there are also a few workshops run by voluntary effort, for the employment of disabled persons willing to do a full day's work but unable to earn their keep in competitive industry.

(*d*) *Mechanically Propelled Invalid Vehicles* are, on a consultant's recommendation, provided by the Ministry of Health for those who have lost the use of their legs and also those whose disability would otherwise prevent them from reaching their place of employment.

Housewives

In some cases where the housewife is arthritic the family manages successfully without outside help. In other cases, however, the family is less united, or may be defeated by bad housing or other difficulties, and without some practical support such a family may break up completely. Of particular value at this stage are the following:

(*a*) *The Home Help Service* (administered by the local health authority and sometimes delegated to the W.V.S.), which usually provides domestic help, and is authorized to charge only according to the patient's means.

(*b*) *The Local Housing Authority* may give some priority to applications for council accommodation, if intended to meet a specific need—for instance, ground-floor accommodation for people with arthritis of the hips or knees—but priority will rarely be given on grounds of diagnosis alone. The housing authority also has powers to adapt council houses or flats for the use of disabled people, such as widening doorways for wheel chairs, or to provide sheds for invalid carriages. Some housing authorities are starting to build special bungalows for chair-bound and other severely handicapped people.

AIDS

Experience has shown that far too many patients make no effort to ease their daily round by the use of aids, however simple. It cannot be too strongly emphasized that self-help is very much a family concern, for in the family group one person cannot continually be left behind. If aids are rejected (the family considering it their duty to nurse their less able member), who can blame the patient for willingly accepting this situation? There are others to whom the feeling of dependence is the hardest burden to bear, and it is here that help is most needed and will be eagerly accepted; but aids must be simple and designed

to ease the strain and give independence, especially in personal matters, rather than to increase activities. Some simple aids are illustrated overleaf.

Disability of the Legs

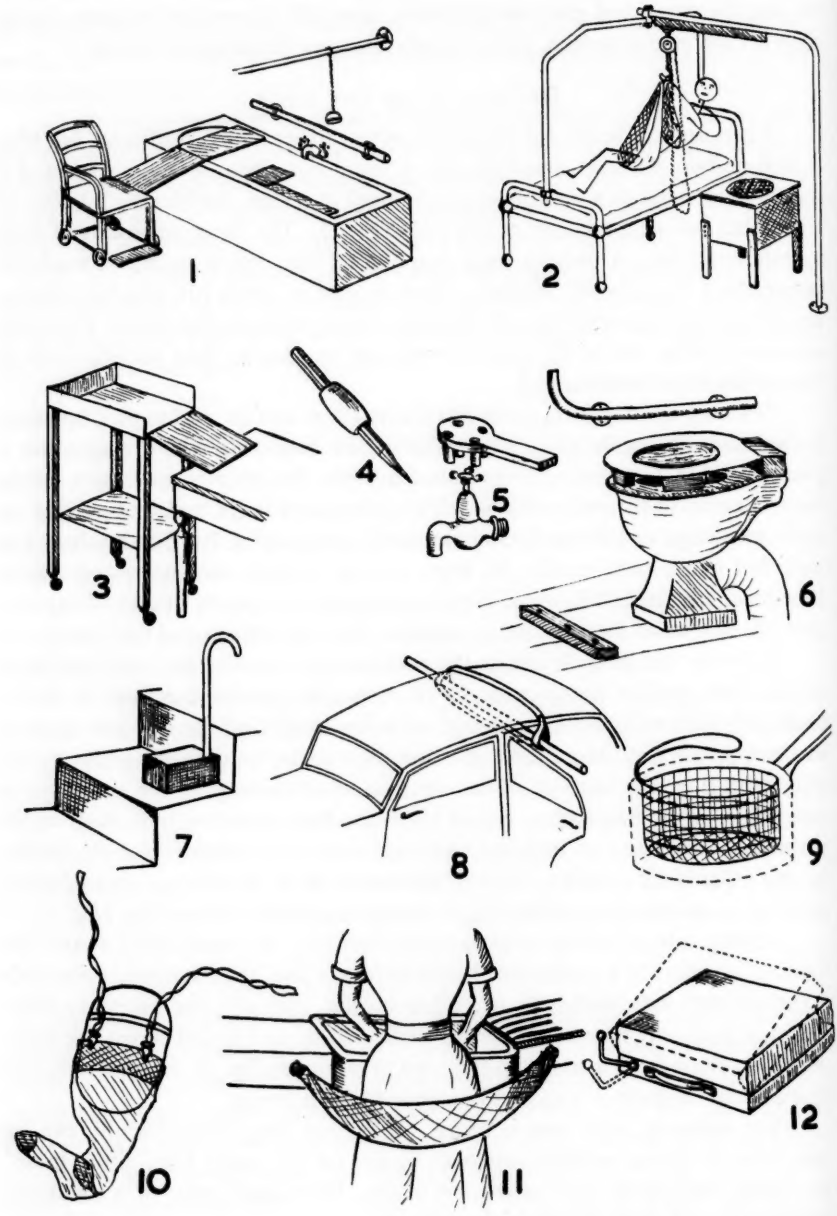
Stairs are a difficulty for the patient whose lower limbs are affected but who is still mobile. To help overcome this a small box about 4 inches high and 8 inches long, fixed to a walking-stick and used as a step, doubles the number of treads but halves the height of the steps (Fig. 7). The same method is of help in entering a bus. A moving stair, working off the electric mains, is available where there is a straight stairway. There is also a simple lift, accommodating one person and taking up very little space, which connects two floors. These are expensive items, but to the house-owner may be cheaper than moving, even if the capital has to be borrowed.

"Picking-up" tools are made in variety. Tongs can be used to pick up many kitchen utensils, while pins and needles can be picked up with a magnet on a piece of string. Garments can be pulled over the feet by means of tapes firmly sewn to socks or trousers and two sticks with a hook in the end. For putting on nylon stockings women can use a home-made gadget (Fig. 10). Slip-on shoes are best, but where these cannot be worn, a long-handled shoe-horn and elastic shoe-laces are helpful. To avoid kneeling, long handles can be fitted to dustpans, shovels, etc., while there are many varieties of suitable mops and brooms.

A trolley the same height as the cooking-stove or sink not only acts as a crutch, but enables heavy pans to be removed without carrying. A stool, preferably with a slightly sloping top, takes the weight off the feet and enables washing-up or the preparation of vegetables to be carried out without full weight-bearing; the same stool can be used when ironing. When supplying a new chair, most manufacturers will leave the legs longer to individual order if specially requested. A bodyline chair will often give comfort not obtainable in any other chair; while a chair is now being made in which a spring, when released, raises the back of the seat, assisting the patient to rise (Fig. 12).

Getting into a bath presents another difficulty. A board fitted across the inside of the bath at a convenient height to form a seat, used in conjunction with a rubber bath mat, wall-bars, or ceiling chains, may give the necessary help. Again, it may only be possible for the patient to sit on a board across the bath, wriggling along from a section jutting out at one side (Fig. 1). A towel attached by elastic to the door or wall may be a great boon in drying.

The ordinary toilet seat is nearly always too low. This difficulty can be overcome by fitting another seat with blocks on the under side, either loose, or hinged and tipped back when not in use. Here again grips or a hand-rail (shaped on each side) assist in rising (Fig. 6).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Disability of the Arms

For patients with weakness of the upper limbs, while some of the previous suggestions may help, aids fall mainly into three groups: (1) those which give greater leverage; (2) those which reduce the need to grip; and (3) those which reduce the need to raise the arms.

Group 1 includes tap-turners, made quite simply with four screws holding short pieces of dowelling in a handle about 8 inches long (Fig. 5). Door keys are more easily turned if the leverage is increased by inserting the head of the key in a piece of wood about 4 inches long. Nut-crackers can be used to open bottles, or an excellent gadget—"unduit"—can be purchased from any hardware store. A wire from the handle to the spout of a teapot may make lifting and pouring possible.

Group 2.—Spoons and handles of all kinds can be enlarged with a bicycle handlebar grip or by binding on strips of sponge rubber. Saucepans need not be tipped for draining vegetables, etc., if a frying basket is first inserted with the handle bent over the top and secured to the other side of the saucepan. This can then be lifted out with its contents and the hot liquid left to cool (Fig. 9). A mixing-bowl fixed in a hole in a board leaves both hands free for mixing; alternatively double-sided suction cups, damped and pressed on to the base of the bowl and the table, will hold it firm. A potato-peeler which can be screwed to a board and clamped to the table allows of the potato being drawn over it.

Group 3 includes aids for feeding, and no trouble must be spared to this end. Spoons and other utensils can be lengthened by adding wood or perspex to the handle, while to keep the contents on the spoon the angle of the bowl may need to be altered by twisting the handle. A piece of elastic over the hand and attached to the handle may give stability. If a cup cannot be raised, nylon tubing, which can be boiled for cleaning and withstands hot drinks, can be used as a drinking tube. Beaker holders for "pyrex" type beakers are fairly heavy, but both hands can be used. To prevent food from being pushed off the plate a child's pusher can be used, or a bunker of "perspex" clipped to the side of the plate. For the toilet many types of sponge mops are sold, and most of these

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Aids for the Disabled (illustrated opposite)

1. Bathing arrangements (*items 10 and 11 in list on pp. 102-3*).
2. Winchester hoist (*item 15*).
3. Crutch trolley and slide to table (*item 3*).
4. Pencil with rubber thimble (*item 23*).
5. Tap turner (*item 28*).
6. Raised lavatory seat, hand and foot bars (*item 9*).
7. Step aid (*item 22*).
8. Bar for helping spondylitics into car (*item 19*).
9. Fish basket in saucepan (*item 33*).
10. Stocking pull-on (*item 5*).
11. Sling belt seat for sink (*item 36*)
12. Chair seat lift (*item 17*).

make excellent sponges to reach the back of the neck or feet. Toothbrushes may be adapted by lengthening or padding the handle. In extreme cases it may be necessary to bend the head to a right-angle by heating the handle for a few minutes until it becomes soft; two brushes would then be necessary, one for the upper and one for the lower jaw. To comb the hair, nylon combs can be drilled and attached to a long handle at an angle.

The introduction of a few aids, not necessarily expensive or elaborate, may do much to alter the life and outlook of the arthritic. Gadgets and modified articles of furniture that have been found valuable are listed below:

Item No.	*Description*	*Obtainable from*	*Approximate Cost*
1.	Spontex mop for toilet	Hardware stores	2s. 6d.
2.	Toothbrush with long or bent handle	Made in department	2s. 9d.
3.	Nail-brush with grip	Stores	2s. 3d.
4.	Long-handled comb—metal	Made in department	2s. 9d.
5.	Stocking pull-on: flat cardboard with tapes (Fig. 10)	Made in department	2s. 6d.
6.	Tie clip	Herbert Terry, 27 Holborn Viaduct, London, E.C.1	9d.
7.	Elastic laces	Radio Chemical Ltd., 78 Upper Richmond Road, London, S.W.15	
8.	Long shoehorn	Made in department	3s. 6d.
9.	Raised lavatory seat and bars to assist rising (Fig. 6)	Made in department	
10.	Bath seat, pulley, etc. (Fig. 1)	Made in department	
11.	Suction bath mat (Fig. 1)	Stores	13s.
12.	Rubber spray for bath or hair washing	Stores	7s. 6d.
13.	Levit bath lift	John Bell & Croyden, Wigmore Street, London, W.1	£48
14.	Small one-man lift	Benic Lifts Ltd., 2 Timworth Street, London, S.E.11	
15.	Winchester pattern hoist with King (Bantam II) pulley block (Fig. 2) (By permission of Dr. Russell Grant)	Pulley block: Messrs. King of Stevenage	£25
16.	"Horder" chair with hydraulic apparatus for raising patient on to feet	Described by Dr. Stewart (*Ann. phys. Med.*, 1953, **1**, 184)	
17.	Seat-lifting aid (Fig. 12)	Powell Seat Co. Ltd., 23 St. James Street, Derby	£5
18.	Bodyline chairs	Through furnishers from Greaves & Thomas Ltd., Clacton, London, E.5	£20
19.	Removable bar slung from roof of car to assist patient with stiff back and hips into car (Fig. 8)		
20.	Adjustable stool	H. E. Lewis, 67 Welbeck Street, London, W.1	
21.	Sloping stool	Adapted in department	30s.

Item No.	*Description*	*Obtainable from*	*Approximate Cost*
22.	Step aid (Fig. 7)	Made in department	
23.	Pencil with rubber thimble (Fig. 4)	Made in department	3d.
24.	Scissor-type pick-up stick	Church Army Rehabilitation for Disabled, 46 Acre Lane, Brixton, S.W.2	10s. 6d.
25.	Nylon drinking tubes	Portland Plastics Ltd., Basset House, Hythe, Kent	1s. 10d.
26.	Perspex plate bunker	Medical Therapeutics	10s. 6d.
27.	Sheppard's castors	Furnishers	35s. set of 4
28.	Tap turner with four prongs (Fig. 5)	Made in department	2s. 6d.
29.	Key grip (wooden with slot)	Made in department	6d.
30.	Vegetable peeler on board	Made in department	2s.
31.	Potato peeler (légumière)		70s.
32.	Nut-brown pastry blender	Stores	3s. 6d.
33.	Fish basket in saucepan for easy straining (Fig. 9)	Hardware stores	2s. to 4s.
34.	Crutch trolley (Fig. 3) 20 × 20 inches	Made by hospital carpenter	
35.	"Flexible Flo" mop	Straight Janes Ltd., Charlton, London, S.E.7	21s.
36.	Supporting belt at sink (Fig. 11)		
37.	Lever or oblong handles for doors		
38.	Cantilever table, adjustable for height for chair or bedside	Furnishers	79s.
39.	Booklet *Everyday Aids for Disabled*	West Sussex Association for the Care of Cripples, County Hall, Chichester	1s.
40.	Booklet *Gadgets*	National Association for the Paralysed, 1 York Street, Baker Street, London, W.1	2s. 6d.
41.	Book *Rheumatism*, by W. S. C. Copeman and R. M. Mason (Modern Health Series: Duckworth, London)	Bookshops	8s. 6d.

CONCLUSION

The treatment of the arthritic patient has altered little in essentials in the last twenty years, in spite of the introduction of the pituitary and adrenal hormones and of phenylbutazone. Big strides have, however, been made in common-sense handling of the patient, both psychologically and physically. Better insight, welfare, resettlement, and the use of aids will often allow a sufferer to remain a useful member of the community instead of being relegated to the category of a useless derelict.

ACKNOWLEDGMENT

The gadgets discussed are selected from a great number utilized, and often invented, by occupational therapy departments throughout the Metropolitan, Oxford, and South-West Regions, and we express our indebtedness to them for many ideas.

ORIGINAL PAPER

EXTREME SLOWING OF NERVE CONDUCTION IN PERONEAL MUSCULAR ATROPHY*

By R. W. GILLIATT and P. K. THOMAS

From the Middlesex Hospital, London

CONDUCTION velocity in human motor nerves is known to be reduced in certain pathological conditions of the lower motor neurone. This was first demonstrated by Hodes, Larrabee, and German (1948) for regenerating nerve fibres after peripheral nerve injuries. A later study by Hodes (1949) showed that conduction velocity was reduced in surviving motor nerve fibres after poliomyelitis, from which it was inferred that poliomyelitis virus tends to attack the large anterior horn cells in the spinal cord. Recently slowing of motor nerve conduction in polyneuritis has been described by Lambert (1956), who mentions that similar changes may occur in Charcot–Marie–Tooth atrophy.

Conduction velocity measurements on a patient with peroneal muscular atrophy (Charcot–Marie–Tooth disease) are described below to illustrate the extreme slowing of nerve conduction which may occur in this condition.

CASE REPORT

Mr. G. M., aged 47 (M.H. No. J14045).

History

No muscular wasting or deformity reported in the patient's family, but he himself could never run as well as other boys at school and was always slow and clumsy when playing games. He was always aware that his feet were deformed with high arches and that they "slapped" in walking. When examined for the Royal Air Force in 1939 he was told that he must have had poliomyelitis in childhood, although he himself had no recollection of this. For many years he had been aware of gradually increasing wasting and weakness of the legs and feet, and more recently a similar change had been noticed in the hands.

Examination

No abnormality in the cranial nerves; no wasting or weakness of trunk or limb girdles, but marked changes peripherally with bilateral pes cavus. In the arms wasting confined to the small muscles of the hands, but all deep reflexes depressed or absent. In the legs some loss of muscle bulk in the lower fibres of quadriceps, but wasting otherwise confined to muscles below the knee, where it was severe with complete bilateral foot-drop. Both knee-jerks depressed and ankle-jerks absent. Marked

* Case presented at the Annual Meeting of the British Association of Physical Medicine, April 6, 1957.

secondary osteoarthritic changes present in both ankle-joints. Mild superficial sensory impairment of glove and stocking distribution to pin-prick and light touch, with preservation of joint sensation in the fingers but some loss of appreciation of small passive movements of the toes.

Electrical Findings

Strength–duration curves indicated denervation of the wasted muscles in the legs, and when the peroneal nerves were stimulated electrically just behind the fibular head there was no visible muscle response on the right and only a flicker of contraction in tibialis anterior on the left.

Electromyography was carried out using a "Stanco" double-channel electromyograph and stimulator, the examination being confined to the small muscles of the right hand. When the right abductor pollicis brevis was sampled with a concentric needle electrode, insertion activity was not increased and no fibrillation was present, but the number of motor units under voluntary control was grossly reduced: some large (5 mV) units were seen. In the right abductor digiti minimi the changes were similar, and in addition there was some increase in insertion activity.

With the recording needle in abductor pollicis brevis the right median nerve trunk was stimulated with short-duration (0·1 msec. square wave) pulses delivered through an isolating transformer. The electrical threshold of the nerve was markedly raised and only a few motor units in abductor pollicis brevis could be activated by stimulation at the wrist, even when using the full output of the stimulator. No motor-unit activity could be obtained by stimulation of the nerve trunk at the level of the elbow. The latency of the earliest motor-unit response when stimulating at the wrist is shown in the accompanying table.

Latency of Muscle Action Potentials with Nerve Stimulation

Muscle	Nerve	Site of Stimulus	
		Wrist	Elbow
Abductor pollicis brevis	Median	14 msec.	No response
Abductor digiti minimi	Ulnar	10 msec.	35 msec.
Normal range*		3–5 msec.	8–12 msec.

* From Simpson (1956)

With the recording needle in abductor digiti minimi the right ulnar nerve trunk was stimulated at the wrist; two motor units could be activated, but only one of these responded when the nerve trunk was stimulated at the elbow, so that it was possible to measure conduction velocity in a single motor fibre, the motor-unit potential having a characteristic appearance with stimulation at both levels. Latency measurements are shown in the table; from the distance between the two sites of stimulation (28 cm.) conduction velocity is calculated to be 11·2 metres per second.

SUMMARY

Conduction velocity in a single surviving motor nerve fibre in the right ulnar nerve was measured in a patient with peroneal muscular atrophy. Extreme slowing of conduction was present with a calculated velocity of 11·2 metres per second in the segment of nerve between elbow and wrist.

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ORIGINAL PAPER

EXERCISES FOR INCREASING MUSCLE POWER IN CERVICAL SPONDYLOSIS

BY GEOFFREY HOVENDEN

From the Department of Physical Medicine, West London Hospital

THE purpose of this communication is to describe certain exercises to strengthen the muscles which maintain the carriage of the head and to emphasize the importance of their use in the treatment of cervical spondylosis. When exercises are prescribed, these are usually given through the range of neck movements; attention should also be given to improving the shoulder–head relationship and strengthening the cervical extensors.

Muscular support is especially necessary after immobilizing treatments such as the application of spinal collars and plasters or bed rest. For when cervical disk lesions are treated by rest, disuse weakness or wasting must inevitably occur. When dis-traction with the Sayre or other apparatus has given relief, symptoms may recur not long after completion of the course of treatment. Manual traction—manipulation of the cervical spine by an "osteopathic" manœuvre—often acts dramatically, but the relief may be only temporary and we frequently hear of patients' regular visits to osteopaths. These important methods of treatment need to be supplemented by stabilizing exercises to prevent relapse, which are equally necessary when the condition has resolved spontaneously.

The following exercises need no special apparatus and can be conveniently carried out in the home. They further have the advantage that they eliminate cervical movement.

METHOD

The patient lies supine on the floor or on a firm couch, with a towel under his head. From a relaxed and painless position he is told to press his head downwards steadily and with progressive force so that the towel cannot be pulled away. If the spine is not too stiff and the patient can manage it comfortably, this exercise should be done at three levels: (1) with the towel only behind the head; (2) a book under the towel; (3) with a 2-inch padding under the shoulders (so putting into action the dorsiflexors, particularly at the thoraco-cervical junction). At each of these levels the patient should press ten times with maximum effort, with an interval of complete relaxation between each effort. (When there is a fixed forward carriage of the head the exercise is possible only with compensating support under the head.)

Use of Weighing Machine

It is a generally accepted principle that motivation is of great importance in carrying out repetitive exercises. The effort made by the patient can be measured by arranging a bathroom weighing machine at correct level on a chair at the end of the examination couch. The patient rests his head on this and the weight is noted (usually about 8 to 10 lb.). He then performs the above exercises and the weight is recorded at maximum pressure. A weak action will show an increase of less than 30 lb.; fair, 40 to 60 lb.; powerful, more than 70 lb. The patient is encouraged to try to increase the poundage, as with daily performance of the exercises (at home or in the physical medicine department) his muscles become more powerful. He may complain that the exercises give rise to neck-ache, and so before he begins he should be warned that he may have the sensation of physiological stiffness due to muscles "going into training".

SUMMARY

Simple muscle-building exercises are described for the treatment of cervical spondylosis; also a method of recording improvement in muscle power by measuring the effort made by the patient by means of a weighing machine.

THE FOURTEENTH ANNUAL MEETING

THE fourteenth Annual Meeting of the British Association of Physical Medicine was held at the Middlesex Hospital on April 5 and 6, 1957. About eighty members attended.

SCIENTIFIC PROGRAMME

On the morning of April 5 five short papers were read, and in the afternoon there was a discussion on "Poliomyelitis". The President, Dr. P. Bauwens, was in the chair.

After the Business Meeting on the morning of April 6 members attended an X-ray demonstration arranged by DR. A. C. BOYLE and DR. J. D. K. PALMER. In the afternoon the clinical meeting was held.

April 5—Morning. Short Papers and Films

DR. J. G. SOMMERVILLE: "*The Work of the Medical Rehabilitation Centre, with Special Reference to the Piercy Report.*"

Dr. Sommerville outlined the five main groups of physically disabled persons as defined in the Piercy Report, and considered the medical aspects of the report. An analysis was shown of sixty-seven cases treated at the Camden Road Rehabilitation Centre in 1955 and 1956. Dr. Sommerville then presented figures analysing certain statistics relating to the work at the Centre, and discussed the methods employed in arranging individual programmes for patients.

A film was shown to illustrate various aspects of treatment at the Centre. Finally all members of the British Association of Physical Medicine were urged to take a full part in the work of rehabilitation in the future, and the influence and responsibility of the Association in carrying out this work were stressed. Some discussion followed, and a certain divergence of views as to the place of the physical medicine specialist in organizing rehabilitation in a general hospital was apparent.

DR. R. W. BARTER: "*A Doctor in the Department.*"

Dr. Barter reviewed the present staffing of physical medicine as a specialty in the National Health Service and considered the work of a consultant in this specialty. He then gave an analysis of statistics relating to clinics and treatments at five hospitals over three years—1954, 1955, and 1956. These included a London teaching hospital, a provincial hospital with a consultant in charge, two provincial hospitals in an area to which a consultant was appointed at the end of 1954, and a fifth hospital with no physical medicine consultant. Dr. Barter suggested that study of the figures indicated that the presence of a consultant in charge of a department reduced the load on physiotherapy services by 10–15%. Improved quality of medical care also followed and ineffective treatments were reduced.

Statistics supplied by the Secretary of the Chartered Society of Physiotherapy were shown. These indicated the increasing gravity of the problems arising from the shortage of physiotherapists. Accurate diagnosis and assessment of patients in clinics play a large part in reducing unnecessary and ineffective treatments.

DR. M. R. JEFFREY: "*Marrow Culture in Rheumatoid Arthritis.*"

Marrow culture is being used to investigate the pathogenesis of normochromic and of iron-refractory hypochromic anaemia associated with rheumatoid disease, using Lajtha's method. Interim results from seven normal and sixteen rheumatoid subjects were presented.

There was an over-all tendency for marrow grown in rheumatoid serum to exhibit a lower proportion of orthochromatic normoblasts after culture than when grown in normal serum. This effect was more obvious in normal marrows. Addition of enough inorganic iron to raise the concentration in rheumatoid serum to normal was followed in all the normal marrows and most of those from rheumatoid subjects by return of the proportion of orthochromatic normoblasts to that found in normal serum.

The effect of iron added *in vitro* was related to the subsequent response to intravenous iron *in vivo*. Of nine rheumatoid patients with hypochromic anaemia, the marrows of five were restored to normal by added iron; in these patients the haemoglobin rose to normal after iron therapy. In four patients whose marrows were unaffected by iron no clinical response occurred.

Marrow seemed to grow equally well in "refractory" or "ordinary" rheumatoid serum. Refractory marrow tended to produce a lower proportion of orthochromatic normoblasts than normal marrow grown in the same serum, and had not been influenced by any agent yet tried. The question of a serum factor stimulating erythropoiesis was being studied, so far with inconclusive results.

DR. J. H. JACOBS: "*Rheumatoid Arthritis Presenting as Tenosynovitis*" (prepared with the assistance of DR. E. HESS and DR. I. BESWICK).

This paper described seven cases in which tenosynovitis was the primary manifestation of rheumatoid arthritis, four of which underwent operative treatment before the true nature of the disease became apparent. The time interval between the onset of the tenosynovitis and the development of arthritis varied from 36 to 2 months. In one case a positive reaction to Rose's test was obtained before any evidence of arthritis developed. It is suggested that, in all cases of tenosynovitis with effusion, a biopsy and Rose's test should be carried out before extensive surgery, chemotherapy, or prolonged immobilization was considered.

DR. D. A. BREWERTON: "*Tendon Lesions in the Rheumatoid Hand.*"

Dr. Brewerton had made a clinical survey of 300 cases of rheumatoid disease. A clear history of trigger fingers was obtained in 101 cases in this group. He stressed the frequency with which trigger fingers cleared spontaneously, leaving no residual disability. Twenty-eight patients in the group were unable to flex one or more of their fingers actively because of tendon lesions. This disability was more likely to lead to permanent deformity.

Minor flexor tendon lesions within the hand were important, as they commonly provided the first evidence of rheumatoid arthritis. Apley's test, which is designed to test the function of flexor digitorum sublimis, proved most useful in detecting early tendon involvement.

Finally, 17 patients in the group had spontaneously ruptured tendons, and 50 patients had lateral dislocation of extensor tendons associated with ulnar deviation of the fingers.

April 5—Afternoon. Discussion: "Poliomyelitis"

The opening speakers in the discussion were Dr. R. W. Gilliatt, Mr. D. M. Brooks, Dr. B. E. W. Mace, and Squadron Leader C. B. Wynn Parry.

DR. R. W. GILLIATT reviewed recent research in the immunological field, commenting on the remarkable advances in knowledge made possible by tissue-culture techniques. Turning to the therapeutic aspects of the disease, Dr. Gilliatt discussed current methods of treating respiratory paralysis, and described in particular the use of tracheotomy and positive-pressure ventilation in bulbar cases, as developed by Lassen and his colleagues at Copenhagen.

The number of patients surviving acute anterior poliomyelitis, but requiring respiratory assistance indefinitely, must inevitably increase with better treatment of the acute illness. Such patients with little or no chance of useful recovery should be regarded as constituting a special problem for which there is as yet no satisfactory answer; too ill to go home, and yet psychologically unsuited to an indefinite stay in an acute respiratory paralysis unit or fever hospital, these patients might benefit most from some new form of long-stay unit.

MR. D. M. BROOKS dealt with the place of surgery in the treatment of poliomyelitis. He considered the indications for operation under the three headings of prevention of deformity, correction of established deformity, and improvement of function. In the prevention of deformity due to muscle imbalance the equilibrium of the foot could often be restored by appropriate tendon transplantation. The results were best when transplantation was combined with Grice's operation. In this operation a bone block is inserted into the sinus tarsi, which abolishes subastragaloid movement. At present there is no effective way of preventing the development of a paralytic scoliosis in those cases in which an imbalance exists in the muscles of the trunk and thorax. Correction of the deformity by plaster of Paris and later spine fusion is the only treatment available.

In the correction of deformity there are certain circumstances in which physiotherapy alone is ineffective, notably when there is shortening of the tensor fascia lata. For this deformity surgery provides a complete and rapid correction. Similarly, in established deformities of the foot bony stabilization offers the best solution when bone growth has ceased.

In dealing with reconstructive surgery of the lower limb it was pointed out that operative intervention was rarely justifiable unless it enabled supportive apparatus to be discarded. Stability was the most important factor. In completely flail legs it was often possible to stabilize the limb by a combination of a supracondylar osteotomy of the femur, to give a slight degree of back knee, with a panastragaloid arthrodesis of the foot in slight equinus. In the upper limb the emphasis lay on restoration of movement, and tendon transplantation is the technique most commonly used. In completely flail arms a certain degree of function can be restored by arthrodesis of the shoulder, arthro-

desis of the wrist, and a tenodesis of the long flexor tendons of the fingers. This has enabled patients to work a self-propelled chair and to use crutches.

DR. B. E. W. MACE discussed the role of physical medicine in a fever hospital. Poliomyelitis patients are most suitable for intensive rehabilitation by reason of their age and outlook, their stable disability, and the preponderance of "white-collar" occupations among them, and its value is probably enhanced by the greater incidence of adult cases. Early physiotherapy is important, but difficult to achieve because of lack of skilled staff. It is necessary to maintain strict control of physiotherapy in epidemic times.

The transfer of patients to long-term centres when no longer infective is unsatisfactory because of the delay often involved. Therefore facilities were established at the Hither Green Hospital for pool therapy and remedial occupational therapy to be carried out at the hospital, thus obviating any delay in starting rehabilitation.

Cases in fever hospitals at non-epidemic times are not sufficient to justify the establishment of this type of centre, but such facilities are equally valuable for the general run of medical rehabilitation. It is suggested that fever hospitals, with their empty wards, are possible sites for future in-patient rehabilitation centres.

SQUADRON LEADER C. B. WYNN PARRY discussed his experiences in the rehabilitation of 120 patients with poliomyelitis sufficiently severe to need in-patient treatment at a rehabilitation centre. He first described the work of Sharrard in connexion with the arrangement of the motor-cell columns in the cord, and drew attention to its importance in establishing the likely prognosis for affected groups. The author then described in some detail the management of cases. All the stops of the physical medicine and rehabilitation organ must be pulled out in the treatment of poliomyelitis: exercises, remedial games, pool therapy, all types of occupational therapy for specific ranges of joints, muscle power, and co-ordination, together with the devising of gadgets, splints, and appliances. By the fourth month intensive and fairly heavy resistance exercises can begin, and as the programme nears completion rehabilitation is increasingly directed towards the patient's future occupation. An effort is made to resettle young adults in better jobs than they would have achieved even had they not been ill. At the R.A.F. centre to which Squadron Leader Wynn Parry's cases were admitted, patients are sent at an early stage to the Government Training Centre at Waddon. The work chosen must be such that it leaves ample energy for hobbies and domestic duties. The importance of differentiation between exercises for strength and those for endurance was then considered, and the subject of trick movements, with or without the assistance of "lively" splints, was discussed.

In concluding, the speaker mentioned the importance of adequately planned treatment, and the desirability of early orthopaedic advice when indicated. Lines of future research were indicated. He ended by declaring that "the logical person to lead the team (that is, in the treatment of poliomyelitis) is the specialist in physical medicine".

The President, DR. P. BAUWENS, then thanked the speakers. DR. A. C. BOYLE, in proposing a vote of thanks to the guest speakers (Dr. Gilliatt and Mr. Brooks), said he thought the symposium had been one of the most instructive held at a meeting of the British Association of Physical Medicine.

April 6. Clinical Meeting

The following cases were presented:

DR. R. W. GILLIATT: *A Case of Peroneal Muscular Atrophy.*

Dr. Gilliatt described the technique used in measuring conduction velocity times and showed the findings in the case demonstrated. He went on to discuss abnormalities of conduction velocity in some other peripheral nerve lesions. The President, Dr. P. Bauwens, spoke in the subsequent discussion.

DR. A. C. BOYLE: *Three Interesting Hands.*

The three cases shown were a case of early sclerodactyly, one of rheumatoid arthritis involving the distal interphalangeal joints (in the absence of psoriasis), and one of pulvillus digitae or knuckle pads of the proximal interphalangeal joints.

DR. J. H. GLYN: *A Case of Scurvy.*

This case, originally referred to as one of osteoarthritis, presented with swelling of the left knee-joint. Dr. Glyn discussed the differential diagnosis and biochemical findings in the case. The dietary history was suggestive, and there was a complete response to ascorbic acid therapy.

DR. R. W. BARTER: *A Case of Post-partum Pituitary Insufficiency.*

The case had presented as postural backache. Extreme fatigue was a marked feature. Amenorrhoea had not occurred, and the main deficiency was in the production of thyrotrophic hormone.

DR. J. D. K. PALMER: *A Case of Polymyositis.*

Dr. Palmer discussed the history and clinical findings. Marked wasting of the shoulder-girdle musculature was evident.

DR. A. T. RICHARDSON, who had carried out an electromyographic examination in this case, described the findings and demonstrated the use of the "frequency analyser" in such cases.

DR. H. V. GOODMAN: *A Case of Arteriovenous Aneurysm.*

The lesion was situated in the left leg. Dr. Goodman discussed the aetiology and differential diagnosis of this condition and showed the arteriograms. There was an increase in the length of the affected leg below the knee.

DR. J. A. COX: *A Case of Morquio's Disease.*

The patient was a dwarf. Dr. Cox discussed the clinical and radiological findings. He had also carried out a study of individuals in the patient's family who showed stigmata of the disease. The family tree was shown, indicating inheritance of the disease by a dominant gene.

ANNUAL DINNER

The Annual Dinner was held at the Royal College of Surgeons, Lincoln's Inn Fields, on April 5. It was well attended by members and their wives, and several distinguished guests were present by invitation.

The toast of "The Association" was proposed by Sir Cecil Wakeley, Bart., K.B.E., C.B., deputizing for the Master of the Worshipful Society of Apothecaries. The President, Dr. P. Bauwens, replied.

The toast of "The Guests" was proposed by Group Captain C. J. S. O'Malley, C.B.E. Mr. J. Cyril Butterwick, Prime Warden of the Worshipful Company of Goldsmiths, replied on behalf of the guests.

R. W. BARTER

ANNUAL GENERAL MEETING

The Annual General Meeting was held at the Middlesex Hospital on Saturday morning, April 6, with Dr. P. Bauwens (President) in the Chair.

The PRESIDENT paid a tribute to the memory of the late Dr. J. B. Mennell, and the meeting stood in silence as a token of respect. The President also paid tribute to the memory of the late Dr. J. D. Thompson, a past member of the Association.

The Minutes of the 1956 meeting were read and approved. The report of Council for 1956–7 was discussed and adopted.

DR. A. T. RICHARDSON outlined the present position regarding the statutory registration of medical auxiliaries.

Officers for 1957–8 were elected as follows:

Vice-President: Dr. H. A. Burt.
Honorary Treasurer: Dr. Donald Wilson.
Honorary Secretary: Dr. G. O. Storey.
Honorary Editor: Dr. A. C. Boyle.

The following new members of the Council were elected:

Dr. H. J. Glanville,
Dr. S. Mattingly,
Dr. N. R. W. Simpson.

The HONORARY EDITOR (Dr. A. C. Boyle) reported on the work in connexion with the change in publishers of the *Annals of Physical Medicine*, which is now produced, in a new format, by Messrs. Baillière, Tindall & Cox. A vote of thanks was passed to Dr. A. C. Boyle for his work in connexion with the *Annals*.

DR. RUSSELL GRANT discussed arrangements for the provincial meeting, which this year is to be held at Winchester.

R. W. BARTER

REVIEWS OF BOOKS

THE FIRST HUNDRED YEARS. *Pp. 88. Brooklyn, New York: Chas. Pfizer & Co. Inc. 1956.*

This is the latest of a series of booklets produced and distributed by pharmaceutical firms who manufacture or sell steroid drugs. While extremely well produced and containing several useful bibliographies, it suffers from certain defects which are common to this type of publication.

After a concise historical survey of the events which led to the discovery of cortisone and its analogues in 1948 there is a very brief but well-balanced section on the chemistry and physiology of these drugs. This is followed by two chapters on systemic administration and the specific diseases in which it is recommended. The use of steroids in dermatology and ophthalmology is then reviewed, followed by a description of their local use in joint disease and in soft-tissue rheumatism. The last chapter deals with recent advances in the uses of these preparations, including the new anaesthetic "viadril" and post-adrenalectomy steroid therapy.

It would possibly be churlish to itemize the inaccuracies and exaggerations in such a commercial publication, the acknowledged purpose of which is to sell proprietary preparations. For example, throughout it is implied (and in five places stated) that hydrocortisone (or "cortil", which is the proprietary name) has certain fundamental advantages over cortisone when administered systemically. This is not the view of most workers in this field, except in certain rare cases which have an idiosyncrasy in this respect; indeed, it has been specifically denied by West and Newns (*Lancet*, 1954, 2, 168).

In the list of clinical indications for the systemic use of hydrocortisone given on page 23 one must disagree completely with the inclusion of osteoarthritis and non-articular rheumatism, and accept with reserve that of gout, scleroderma, chronic asthma, lymphatic leukaemia, multiple myeloma, and Hodgkin's disease (p. 38). When recommending maintenance dosage, no differentiation is made between the sexes or different age groups, though such differentiation is of great importance. Furthermore, the maximum doses recommended for the intra-articular injection of large joints—25–37·5 mg.—is, in our experience, far below the safe optimum.

Provided it is thus read critically, this is a welcome publication and far above the standard of its kind.

J. H. GLYN

THE ADAPTATION OF RECREATIONAL ACTIVITIES FOR MEN IN THE REHABILITATION OF LOWER LIMB INJURIES. By Veida Barclay. *Pp. 154. 18s. 6d. London: G. Bell & Sons Ltd. 1956.*

Medical men working in rehabilitation centres realize the value of recreational activities in their rehabilitation programmes; in fact the "games period" is a very important part of the regime. Miss Barclay in this book gives extremely detailed descriptions of these games and activities.

The book is well produced, the diagrams are clear, and the illustrations are good. I question, however, whether the teaching and practice of such a specific skill as vaulting is appropriate to the rehabilitation of the average man with a lower-limb injury.

This is my only criticism of a very excellent description of recreational activities in a well-adapted programme.

I can commend this book to all physiotherapists, physical training instructors, and remedial gymnasts. Specialists in physical medicine could also be helped in implementing a suitable programme for their patients.

C. J. S. O'MALLEY

ANNOUNCEMENT

THE Editorial Board of the *Archives of Physical Medicine and Rehabilitation* has established a special subscription rate of $5.00 per year to be granted to bona-fide residents in physical medicine and other specialities in the United States, its territorial possessions, Mexico, Canada, United Kingdom, and Europe. The following rules apply: (1) The subscription may be entered for a period not to exceed three years. (2) All orders for this special rate must be accompanied by a letter of verification from the director of the training programme confirming the resident's status and the number of years remaining in the resident's training programme. (3) This special rate is not applicable if less than one year of training remains to be completed in the applicant's residency programme. (4) The subscription is not transferable and must be entered in the resident's name. It cannot be sent to a hospital, organization, institution or a person other than the subscriber.

Those desiring to avail themselves of the special rate to residents should write to: *Archives of Physical Medicine and Rehabilitation*, 30 N. Michigan Avenue, Chicago 2, Illinois, U.S.A.

ABSTRACTS OF THE LITERATURE

Discussion on an Evaluation of the Methods of Increasing Muscle Strength. H. D. DARCUS. *Proc. roy. Soc. Med.*, 1956, **49**, 999.

This is a long and interesting review, with a full bibliography, of an important subject. The author traces the historical background of exercises to increase muscle strength. He distinguishes strength and endurance, and points out that there are many aspects of muscle function; thus a training programme which improves one function may adversely affect another. He considers different physiological units where improvement in function may occur—as, for instance, the muscle fibre, the circulation, the nerve, or the spinal cord. He discusses the physiological basis of motivation and the relationship to this of the various systems —the spindle system, the anterior horn cell system, and the higher centres. He points out that there are many different ways of giving exercise—isometric, isotonic, static, dynamic, high repetition, low resistance, low repetition, high resistance—and that little is yet known as to the relative advantages of each. He concludes by stating that we need to know the changes that occur in the neuromuscular system with exercise, by what methods these can be brought about, and their relationship to functional recovery.

C. B. WYNN PARRY

Joint Paracentesis from an Anatomic Point of View—I. Shoulder, Elbow, Wrist and Hand. J. A. MILLER jnr. *Surgery*, 1956, **40**, 993.

Anatomical studies were undertaken for the specific purpose of improving the technique of intra-articular hydrocortisone injection. In recommending a site or an approach for injection the following points were considered important: (1) distance from large nerves, blood vessels, or tendons; (2) use of bony landmarks rather than absolute measurements as a guide; (3) enlargement of the target area by dis-traction and positioning of the joint; (4) use of positioning to ensure accurate palpation of bony landmarks; (5) use of positioning to stretch that part of the capsule which it was planned to pierce; and (6) avoidance of scoring of articular cartilage.

Approaches to the subacromial bursa, the scapulohumeral articulation, the humeroradial articulation, the olecranon bursa, and the radiocarpal, intercarpal, carpometacarpal, metacarpophalangeal, and interphalangeal articulations are accurately described and discussed.

[This is a strongly recommended paper which should help to reduce the number of failures of hydrocortisone injection due to faulty technique.]

D. C. ARNOTT

Tietze's Syndrome. H. L. KAYSER. *Amer. J. Med.*, 1956, **21**, 962.

The author reviews the literature on Tietze's syndrome and describes a further case. The condition may be defined as a painful swelling of a costal cartilage, usually the second, which may persist indefinitely; its cause is unknown, and biopsy of the affected cartilage usually reveals normal tissue.

S. MATTINGLY

The Diagnosis of Cerebral Palsy in Infancy. K. BOBATH and B. BOBATH. *Arch. Dis. Childh.*, 1956, **31**, 408.

The earlier treatment is begun in cerebral palsy the better are the results to be expected and the less is the likelihood of abnormal movement patterns becom-

ing established. Because of this the authors, in common with most workers in the same field, stress the importance of early diagnosis. Certain important aspects of normal early motor development are described and compared with the abnormal development of the child with cerebral palsy.

The main difficulty in early diagnosis is to differentiate between a general retardation of motor development due to other causes and a retardation due to disturbed reflex activity.

It is at the stage of development when predominant flexor tone gives way to prominent extensor tone that abnormal spasticity may begin. At this time, in some types of cerebral palsy, certain tonic reflexes increase in strength when normally they should become less active. Of these reflexes the asymmetrical tonic neck reflex, the tonic labyrinthine reflex, and the positive supporting reaction are discussed. The authors use a number of tests based on these reflexes, the purpose of which is to elicit or provoke abnormal muscle tone or abnormal postural reflex activity at a stage when gross spasticity is not yet apparent. The tests are described in detail and well illustrated. The early diagnosis of athetoses is briefly discussed.

D. C. ARNOTT

The Scalenus Anticus Syndrome. A. STOWELL. *J. int. Coll. Surg.*, 1956, **26**, 711.

This is a review of 230 cases of the scalenus anticus syndrome. The author divides the condition into two types—primary, in which no cause is found; and secondary, following injury. The following symptomatology is described. The pain is usually dull, aching, and diffuse. It is felt in the medial side of the elbow and hand and often radiates to the occiput and below the scapula. Numbness is felt when the patient lies down or when the arm is outstretched. The pain is intermittent and may be accompanied by minimal weakness. Commonly the triceps jerk is diminished or absent. The most important diagnostic sign is pain reproduced by pressure in the scalene triangle. Pulse obliteration tests are unreliable.

Treatment advised by the author includes intramuscular vitamin B_{12}, sedatives, heat, and shoulder exercises. If the condition does not respond in one month, neck traction is used. If operation becomes inevitable, excision of 4 cm. of the muscle belly as well as tendon section is required to prevent recurrence. A complete cure following surgical treatment can be expected in two-thirds of patients. C. B. WYNN PARRY

Radiotherapy in Arthritic Conditions. G. KERSLEY. *J. Fac. Radiol.*, 1957, **8**, 181.

This is an account of the use of radiotherapy in 788 cases of osteoarthritis, rheumatoid arthritis, and ankylosing spondylitis. Patients were placed in one of four groups by random sampling; in the first three groups radiotherapy was given in graded dosage, the fourth group acting as controls.

The best results appear to have been obtained in patients with ankylosing spondylitis, where doses larger than 1,500 skin r were unnecessary; relief of pain was often dramatic, though it was unlikely that radiotherapy affected the course of the disease. The response of osteoarthritis to large doses of radiotherapy was sometimes dramatic, though many cases failed to respond. Results of treatment in rheumatoid arthritis were disappointing. It is concluded that radiotherapy may be helpful in the treatment of the arthritic patient, but is no substitute for general medical care.

S. MATTINGLY

The Incidence of Leukaemia in Ankylosing Spondylitis Treated with X-rays. J. D. ABBATT and A. J. LEA. *Lancet*, 1956, **2**, 1317.

In an attempt to determine the incidence of leukaemia following X-ray therapy of ankylosing spondylitis the records of 2,026 men with this diagnosis were studied. In order to check the validity of the diagnosis, random samples of radiographs were examined by an independent panel of experts appointed by the Medical Research Council. Of the cases examined, 1,627 had been treated by irradiation. The expected number of deaths from leukaemia was calculated to be 0·17 in the 399 cases which had not had X-ray therapy, and in fact none was observed. In the irradiated group 0·33 death was expected and 7 occurred. The odds against this excess of deaths being due to chance are stated to be somewhat greater than 1,000,000 to 1.

The exact role of deep X-ray therapy in the production of leukaemia in ankylosing spondylitis is not yet certain, but it seems to have played a major part in the cases observed in the present study.

D. R. L. NEWTON

Discussion on Cervical Spondylosis. *Proc. roy. Soc. Med.*, 1956, **49**, 197.

Sir Russell Brain, who opened the discussion, drew attention to the fact that cervical spondylosis was a major cause of serious disability. He reviewed the aetiology, mechanisms, and differential diagnosis of disk protrusion.

Dr. Ritchie Russell warned that since cervical spondylosis was so frequently found without symptoms a critical approach was necessary. He drew attention to the fact that pressure on mixed nerves usually produced numbness and paralysis without pain. He therefore believed that pressure in itself was not the cause of painful neuropathies, but that pain depended on the development of a neuritis or radiculitis with changes in the nerve sheath. Treatment should be directed to relieving this.

Dr. Hugh Miller pointed out that 80% of males over 50 years of age had radiological changes in the cervical spine, and that usually these were asymptomatic. Some had occasional stiff neck, and some trivial neurological signs or symptoms, but very few developed disabling symptoms. Recently there was a tendency to miss other lesions and to ascribe the patient's symptoms to cervical spondylosis. There appeared to be a relationship between symptoms in cervical spondylosis and emotional disturbances.

Mr. J. E. A. O'Connell reviewed the place of surgery in treatment. Surgery was most effective when symptoms were due to pressure from a displaced disk: this could be suspected when X-ray examination showed changes localized to one disk space. Surgery was less effective when changes of the degenerative type were more widespread or after damage to the cord had resulted.

G. O. STOREY

The Roentgen Diagnosis of Herniated Disk with Particular Reference to Diskography (Nucleography). W. G. PEACHER and R. P. STORRS. *Amer. J. Roentgenol.*, 1956, **76**, 290.

The authors discuss the indications for myelography and describe difficulties that may be encountered in the interpretation of the results, particularly the fact that a disk protrusion may be present with a normal myelogram. The indications for and limitations of discography are discussed and the results compared with those obtained by myelography. The technique is described using a 20–22 gauge lumbar-puncture needle 3½–4 inches long. The needle is inserted with the patient in the lateral recumbent

position as for lumbar puncture, a normal disk taking 0·5–1·0 ml. of diodone and a herniated or degenerated disk 3–5 ml. The dye may remain in the disk for a period of 20 minutes to as long as 24 hours. The radiological appearances of normal and degenerated disks are described, as well as those of degenerated disks with protrusion and of those with frank herniation.

As the needle pierces the disk substance for the injection of the radio-opaque substance pain of a root distribution is often felt by the patient. In cases explored at operation after discography the findings corroborated the radiological data as to pathology and level of the lesion in 39 out of 48 cases.

The authors emphasize the importance of initiating the investigation of a case with myelography as this is conclusive in 90% of cases, and that discography should be employed only in the remaining 10% where negative or equivocal myelograms are obtained.

B. G. B. CHRISTIE

"Hypertrophy" of the Ligamentum Flavum Simulating the Protruded Lumbar Disk Syndrome. W. S. POLLARD and H. J. SVIEN. *Proc. Mayo Clin.*, 1956, **31**, 654.

A case which exhibited features suggestive of a recurrent lumbar intervertebral disk lesion is described. After failure of conservative treatment, myelography revealed the presence of a filling defect situated posteriorly opposite the fourth lumbar interspace. Operative exploration showed marked localized thickening of the ligamentum flavum, removal of which led to cure of the symptoms and the almost complete disappearance of abnormal physical signs.

The literature dealing with this syndrome is reviewed. The apparent hypertrophy of the ligamentum flavum is in fact due to a patchy fibrosis which results from repeated minor strains or detachments with associated small haemorrhages, the end-result being that the ligament becomes thicker and more inelastic.

D. R. L. NEWTON

The Clinical Result of a Personal Series of 300 Operations for Parkinsonism. I. S. COOPER. *J. Amer. geriat. Soc.*, 1956, **4**, 1171.

The operation performed by the author was either occlusion at the anterior choroidal artery or chemopallidectomy. This latter consists in the injection of absolute alcohol into the globus pallidus; it was performed in 245 cases. Relief from rigidity and tremor in the contralateral limbs was obtained as a lasting feature in 70% of cases. Serious complications—namely, death, hemiplegia, mental disturbance, and speech defects—occurred in 6% of the cases. Occlusion of the anterior choroidal artery was performed in 55 cases, but the results were less good.

The author concludes that the operation of occlusion should be reserved for patients under 55 with severe incapacitating illness of long standing, and that chemopallidectomy is usually the operation of choice.

G. O. STOREY

Rehabilitation in Orthopaedic Practice. J. D. MALLOCH. *Brit. J. phys. Med.*, 1957, **20**, 32.

This is a review of the work of Harlow Wood Orthopaedic Hospital rehabilitation department. The centre has 30 beds. In 1955, 208 patients were treated, 102 having knee derangements and 41 spinal disorders. The average stay was 28·7 days; 63% returned to normal work and 24% to lighter work.

C. B. WYNN PARRY